

CARRYING CAPACITY ASSESSMENT FOR ECO-TOURISM IN THE SUNDARBANS ECOSYSTEM, BANGLADESH

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Abstract: The Sundarbans, the largest single tract of mangrove ecosystem in the world, is important both ecological and economic perspectives. This pristine ecosystem was declared as Ramsar site in 1992 and 'World Heritage' site by UNESCO in 1997. Its ecological importance is associated with its rich biodiversity and the ecosystem's valuable services. Natural beauty and integrity of the Sundarbans is, thus a wonderful site for recreation and tourism. Therefore, the research is an attempt for the assessment of tourists carrying capacity, based on a robust analysis followed by environmental, socioecological conditions. The research was carried out in 7 different spots in the Sundarbans namely Karamjal, Dubla, Herbaria, Kalagachya, Kotka, Kochikhali and Nilkamal. Result shows that the tourism in the Sundarbans is seasonal, mainly winter based. In terms of tourists revenue earnings, about 48% of total revenue is national and about 52% is international tourists contribution. Socioecological survey shows the tourists are satisfied overall; however, the tourists were not satisfied with the waste disposal and sanitary management in all spots. Analysis of physical and real carrying capacity both shows maximum numbers of tourists in Karamjal (9450 tourists/day and 1950 tourists/day respectively), physical was lowest in Dubla (2400 tourists/day) whereas real carrying capacity was found lowest (146 tourists/day) in the Nilkamal (Hironpoint Keora Shuti). We conclude, the carrying capacity is not fixed and it could be changed by enhancing management and logistic capabilities, addition to this more detailed research is needed for a detail understanding and better management of the Sundarbans.

Keywords: The Sundarbans, Ecotourism, Carrying capacity and Ecosystem

1. Introduction:

The Sundarbans, the largest single tract of mangrove ecosystem in the world, is important both ecological and economic perspectives. This pristine ecosystem was declared as Ramsar site in 1992 and 'World Heritage' site by UNESCO in 1997. Its ecological importance is associated with its rich biodiversity and the ecosystem's valuable services. The Sundarbans is home to an estimated about 505 species of wildlife, including 355 species of birds, 49 species of mammals, 87 species of reptiles, 14 species of amphibians as well as emblematic species such as the Bengal Tiger (Hussain, 2014). Additionally, there are about 234 species of flora and more than 300 species fish, which includes 237 species of finfish, 38 species of shellfish and 34 species of mollusks also enrich the ecosystem. It acts as a buffer in protecting inhabitants of numerous human settlements against cyclones, rising sea tides and other hazardous weather events. In addition to its ecological functions, it supports livelihoods of about seven million people living in the vicinity of the forest directly and indirectly (Sarker, 2012; Hussain et al., 2014). Apart from timber, thatching materials, fuel wood, honey, wax and shells, the natural beauty of the Sundarbans is a wonderful site for recreation and tourism.

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Sustainable form of land use, which contributes to environmental conservation, while providing accrued socio-economic benefits to the indigenous people through the non-consumptive uses and indirect values of the natural biological resources is termed as ecotourism. However, the features of the tourism sites and the prevailing physical conditions are important consideration for tourism activities (Leung and Marion, 2000; Leung et al., 2001). Erosion, damage to vegetation, fires, water depletion and pollution, disturbance to wildlife are some of the impacts that arise from the tourism activities (Buckley and Pannell, 1990). The greater the number of visitors in a protected area, the greater is the environmental impact (Evans, 2001). In this context, managers have to deal with the issues of how much the degree and extent of change that is acceptable to a natural area. It is reported in the Integrated Resource Management Plans for the Sundarbans for 2010-2020 that about 10000 persons are annually visited the Karamjal site for day long and about 10,000 person was visited annually at Kotka for overnight. This management plan has also noticed the increased number of tourist at the Karamjal site could be alarming in near future. Eco-tourism could be promoted in the Sundarbans considering the carrying capacity of the tourist spots. Therefore, assessment of tourist carrying capacity in different spots of the Sundarbans is very much essential for the proper management of tourist and their satisfaction. It is necessary for providing the safeguard for the biodiversity and wildlife habitat. However, study on carrying capacity for the different tourist spots of the Sundarbans ecosystem is scarce in Bangladesh as well as in the Indian part. Therefore, it is an urgent need to measure the tourist carrying capacity of each existing sites as well as for the new sites for the sustainability of the spots. A careful planning is needed to attract both the local and foreign tourist considering the huge demand and opportunity of ecotourism in the Sundarbans. So, well circulation of tourist attraction of different spots of the Sundarbans, visitor management, minimum facilities, security to visitors, building public-private partnerships with Forest Department and private tour operators are essential for sustainable ecotourism development in the Sundarbans. The information presented for the Sundarbans should be based on a analytical assessment basis in the context of time and area. The assessment of carrying capacity should be based on a robust analysis of environmental, socioecological conditions of the area and evaluation of existing physical, economic and social limits of tourist activities. An important feature of visiting the Sundarbans is not only its natural history, but also the biodiversity conservation activities transpiring at all times within the Sundarbans ecosystem. Therefore the objective of the research is-

Assessment of tourist carrying capacity of different sites (Karamjal, Dubla, Herbaria, Kalagachya, Kotka, Kochikhali and Nilkamal) of the Sundarbans-

Specific objectives are:

- (i) Assessment of the trends of tourism in the above mentioned 7 (seven) sites
- (ii) Documentation of tourist activities in the said sites
- (iii) Identifying impacts of existing tourism
- (iv) Baseline survey on the existing facilities, resources, and attraction of the sites
- (v) Identifying the limiting factors of tourism carrying capacity
- (vi) Assessment of physical, real and effective carrying capacity

2. Method

The research is based on secondary data and primary data. The information collected then used to make an assessment of the values of the areas, its resources and its commercial activities and the attitudes of visitors. The most widely used method for collecting detailed information on visitors is visitor surveys based on questionnaires and it is adopted for this study. The questionnaires were pre-tested and due changes also made for ensuring their effectiveness. The questions were related to socio-demography measures namely information source about the sites, number of visit, type of travel group, duration of stay, lodging at, mode of transport, main purpose of visit, sex, age, education level and occupation. Some questions were related to facilities available, knowledge regarding guide services; identify the types of disturbances they found in the sites, level of satisfaction, recommending the site to friends and reason for the recommendation and any particular suggestion for the improvement of the site. Tourism carrying capacity for the different sites of the Sundarbans was estimated according to Cifuentes A .M. (1996) and Ceballos-Lascurain (1999). SPSS 21 package and excel was used to analyze the data.

The Study area: The Study area was the Sundarbans 7 different spots (Karamjal, Dubla, Herbaria, Kotka, Kochikhali, Kalagachya and Nilkamal) (please see annexure 1 for the study area map)

3. Results and Discussions:

i. *Trend of tourism:* Trend of tourism in the said spots of the Sundarbans is evaluated from the secondary data number of visitors and boats, and amount of collected revenue during last 10 years (2003-2012) from the Sundarbans East forest division (Karamjal, Dubla, Herbaria, Kotka, Kochikhali) and West forest division (Kalagachya and Nilkamal) (please see annexure 1 for the site map). Data show the number of tourists is declining in the year 2007 and 2009 due to Cyclone *Sidr* struck the south-west coast of Bangladesh and Cyclone *Aila* respectively. In addition to that data represent that political instability was another cause of low rate of tourists during yr.2013. Result shows that about 97% of tourists are local and contribute 48% of total revenue whereas international revenue is about 52% though the international tourists are about 3%. The similar trend was found in case of the west forest division though the collected data were available for 5 years (2009-2013). Weather support tourist activities, it is a natural tourism resource and it is an element that, thanks to human intervention, facilitates tourism and the satisfaction of demand (Martin, 2005; Coombers et al., 2008), annual visit pattern of total tourists shows that tourism in Bangladesh is seasonal and suitable for the winter, November is the highest crowd (survey, 2015) month for tourism.

ii. *Meteorological and tidal data:* These data were collected from Bangladesh Meteorological Department (BMD), Dhaka. The research was concerned about the prediction of cyclonic storms in the Bay of Bengal and the Sundarbans with signal no.3 (in this signal, all fishing boats and trawlers over the have should remain close to the coast. The weather data were collected from 1996 to 2012 and result shows that the signal 3 (Fig 1) occurring mostly during the month of June. Average total rainfall was observed highest during the month July (Fig 2) and lowest in the December.

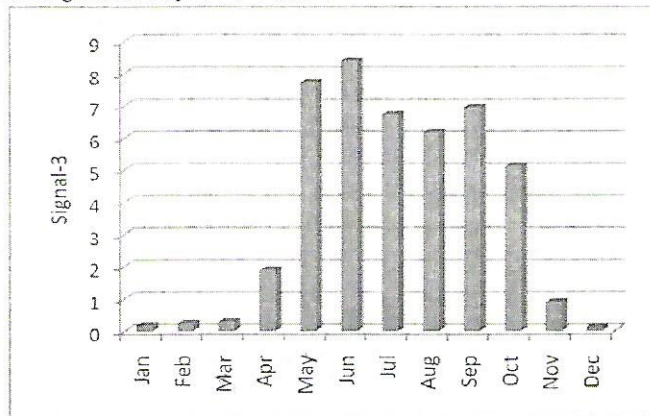


Fig 1: Average monthly climate cyclone signal 3 from yr.1996-2012

Therefore, the tour relevant people could plan in future in the way that, they could avoid the natural obscures.

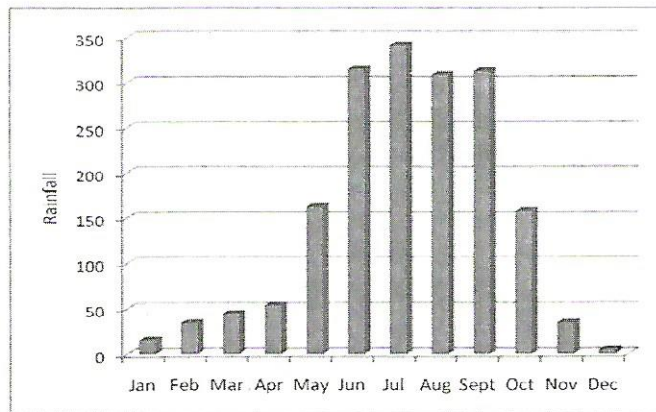


Fig 2: Average monthly rainfall data from yr.1996-2012

- iii. *Visitor survey*: Sustainable use of protected areas by visitors is ensured through careful planning and management (Newsome et al., 2002). The protected area managers can effectively manage the tourist site when there is an availability of quality information. The collection of visitors data provides them with information of the best facilities and services that they can provide to meet visitor needs (Wardell and Moore, 2005). The type of information needed for effective management, included the types of visitors, visitor's activities in the site, and their level of satisfaction with their visit to the tourism areas. The tourist survey for this research was done in the Karamjal, Dubla, Herbaria, Kalagachya, Kotka, Kochikhali and Nilkamal) of the Sundarbans. A total 904 number of people were surveyed from the 7 different spots eg. Karamjal (n=183) Dubla (n=120) Herbaria (n=121) Kalagachya (n=120) Kotka (n=120) Kochikhali (n=120) Nilkamal (n=120) respectively. The survey shows, engine boat is the major vessel using in the tourism purpose (Fig 3).

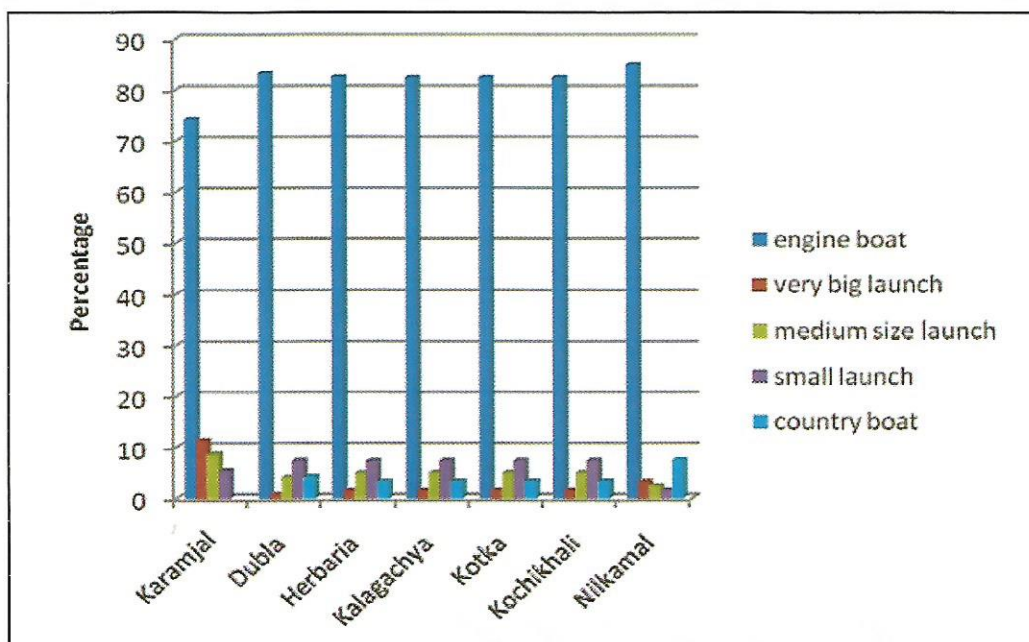


Fig 3: Types of water vessel for tourism in 7 spots in the Sundarbans

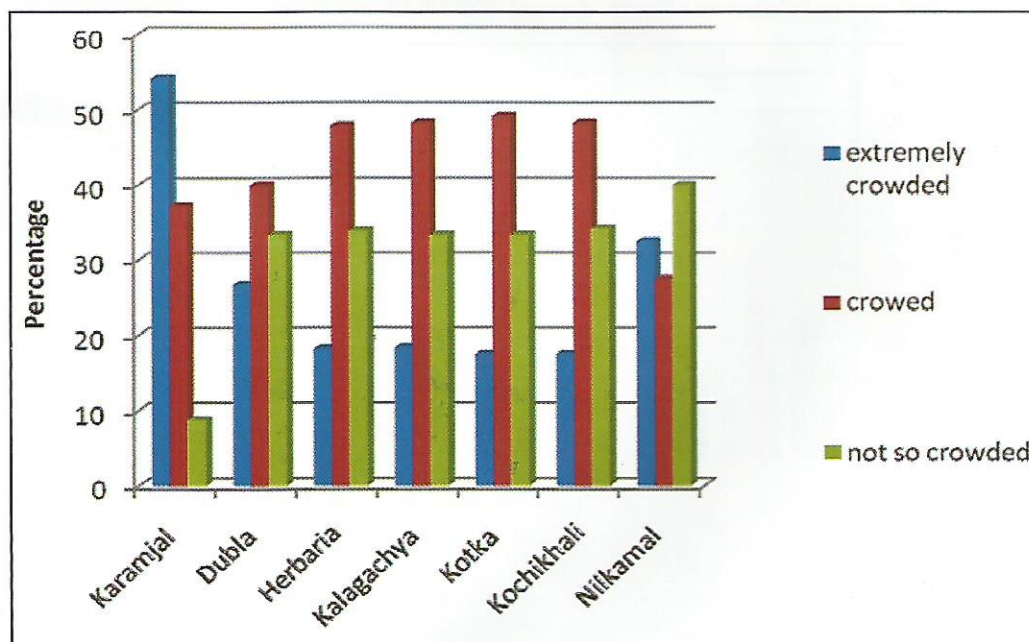


Fig.4: Tourist crowd in 7 different spots in the Sundarbans

In case of crowd Koromjal is the most crowded spot among others (Fig4). Satisfactions regarding money expenditure in the visit, total tourists were moderately satisfied and in terms

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of spot ranking all were agreed on the Nilkamal and Karamjal in the preference list respectively. Satisfaction regarding waste disposal and sanitation management major tourists was not satisfied (Fig.5 and 6).

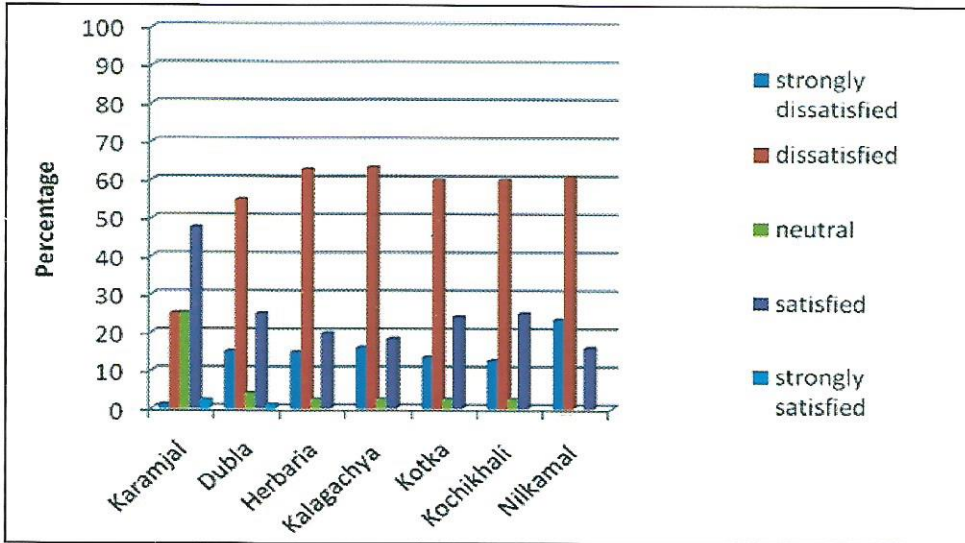


Fig 5: Tourists satisfaction of waste disposal in the 7 different spots of the Sundarbans

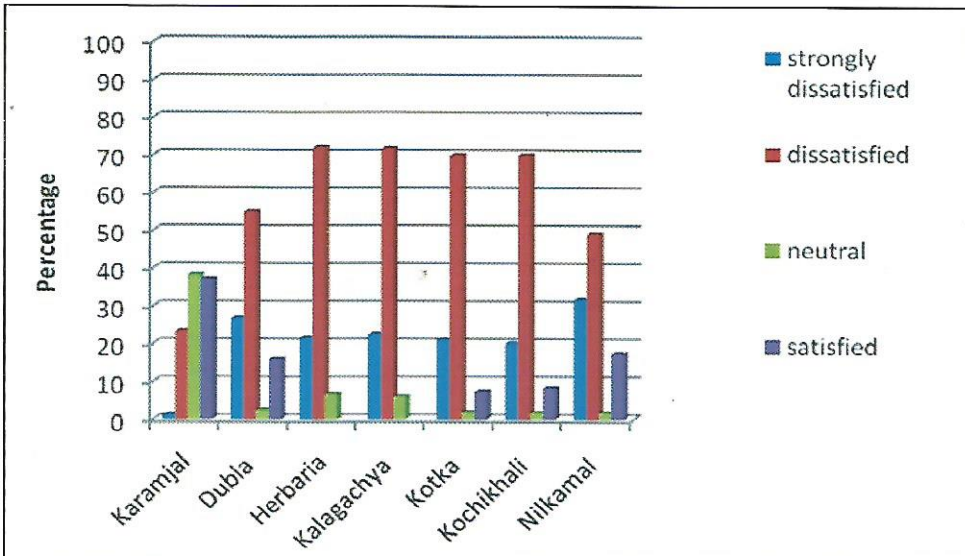


Fig 6: Satisfaction of tourists regarding sanitation in the 7 different spots of the Sundarbans

Though the tourists were satisfied regarding the total tour overall, whereas the waste and sanitation management is the main concern in the tourist spots. Therefore the forest department, Bangladesh may take initiatives to solve the management problems in a holistic

way by inviting all other stakeholders for the sustainability (see Martin and Uysal, 1990; Leung and Marion, 2000; Higham and Carr, 2002).

iv. *Sharing with the stakeholder*. Tourism in Bangladesh is not yet fully flourished, rather a developing industry. In recent times, Ministry of Civil Aviation and Tourism has been playing a vital role in promoting tourism in Bangladesh. However, a workshop and discussions session (Fig 7), a training of relevant stakeholders (Fig 8), a national conference (Fig 9) is organized among the Bangladesh forest department personnel, Universities, ministry of civil aviation and tourism personnel, tour operators, tour guides, and other stakeholders to get their understanding on the present eco-tourism in different sites of the Sundarbans, and the impacts of existing tourism on the Sundarbans. Information sharing and close consultation is held to promote ecotourism in the Sundarbans involving Forest Department and Tourism Board. All argued that a good and valid tourism policy from the government is necessary. Policies need to be made by informed decision-makers considering the interests of the stakeholders. It means that private industry, landowners, community leaders, educators, etc. all need to be informed and involved in the decision-making process from the beginning (Moinuddin and Begum, 2004).



Fig 7: Group discussion in the tourism workshop analyzing the strength and weakness

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Fig 8: Ecotourism capacity building training of the relevant stakeholders



Fig 9: National conference for sharing ecotourism knowledge of relevant stakeholders

v. *Field Survey*: Detailed field survey was conducted in the selected tourist sites on the existing facilities, resources, attractions, trail length, canal width and length according to Snedaker and Snedaker (1984). Moreover, the result of the baseline survey was crosschecked with the secondary data that are available for the sites. Tourism carrying capacity for the different sites of the Sundarbans was estimated according to Cifuentes (1992) and Ceballos-Lascurain (1996). The assessment of different types of the carrying capacity of each sites were estimated as follows:

a. Physical carrying capacity (PCC)

PCC is defined as the maximum number of visitors that can physically fit into a defined space, over a particular time, expressed according to the following formula:

$PCC = A \times V/a \times R_f$ Where, A = available area for public use, V/a = one visitor per m² Rf = rotation factor (number of visits per day)

b. Real carrying capacity (RCC)

RCC is defined as the maximum permissible number of visits to a site, once the corrective (i.e. reductive) factors derived from the particular characteristics of the site have been applied to the PCC. These corrective factors are obtained by considering biophysical, environmental, ecological, social and management variables. RCC is expressed by the following general formula:

$RCC = PCC - Cf_1 - Cf_2 - \dots - Cf_n$, Where Cf is a corrective factor/limiting factor expressed as a percentage. Thus, the formula for measuring RCC is:

$$RCC = PCC \times \left[\frac{(100 - cf_1)}{100} \times \frac{(100 - cf_2)}{100} \times \dots \times \frac{(100 - cf_n)}{100} \right]$$

Corrective factors (cf) are expressed in percentage terms, using the following general formula:

$Cf = (Ml/Mt) \times 100$, Where, Cf = corrective factor, Ml = limiting magnitude of the variable, Mt = total magnitude of the variable.

c. **Effective or permissible carrying capacity (ECC):** ECC is expressed by the following general formula: Effective carrying capacity (ECC) = $RCC \times MC$ where MC = management capacity

Table 1: Tourists carrying capacity of 7 different spots in the Sundarbans, Bangladesh

Name of the Spots	PCC/day	RCC/day	ECC/day
Kotka office site	4200	296	173
Kotka to Jamtala site	4200	925	539
Kochikhali	5100	259	182
Nilkamal (Hironpoint Keora Shuti site)	3900	146	86
Nilkamal (Hironpoint Trail behind the office site)	4500	468	276
Dubla	2400	591	236
Harbaria	7200	1552	932
Karamjal	9450	1908	1145
Kolagachia	4950	1005	647

Conclusion

The research is first of its own in Bangladesh and an initiative of Khulna University, Bangladesh Forest Department with the financial support of the World Bank. Regarding the method, the issue is, regarding mangrove, the carrying capacity assessment method is scarce or absent. However, the parameters used in this research assessing the carrying capacity could be a benchmark, advanced by addition or deduction in future for getting a detailed and clear picture of ecotourism practice in Bangladesh. Secondary data could be use a direction of tourist season and pick time (Martin and Uysal, 1990). Data show the disturbance of wild life (Krumpe and McCool, 1997) during the breeding season of the tiger,

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birds and other wildlife's. The visitors age group is mainly 20 plus and mostly dominated by male. Therefore the disturbance could avoid by promoting ecotourism in those spots. Assessment of Carrying capacity is not a fixed term (Lone et al. 2013). It develops with time and the growth of tourism and can be affected by management techniques and controls (Saveriades, 2000) it can be changed or extended through the extended management capacities and management controls (Butler, 1991; McCool and Lime 2001). This research could be act as a basic reference for the carrying capacity promoting ecotourism (Duffus and Dearden's, 1990). We hope to continue in future with available funding and time to get a detailed insight of all parameters of more spots through the Sundarbans.

Recommendations:

Following recommendations are drawn from overall interaction with different stakeholders through the Survey, Workshop, Training and the Conference during the project, all are agreed on protecting, conserving the nature and wildlife of the Sundarbans through proper monitoring and activities in a holistic way, such as-

1. To respect the integrity and frailty of the Sundarbans and realization that, unless everyone is willing to help preserve its unique and beautiful destinations, future generations may not have the opportunity to enjoy them.
2. To ensure proper tourism guidelines by the forest department, Bangladesh Parjatan Corporation, Bangladesh Tourism Board and other concerned Government authorities for tourism in the Sundarbans. All should respect the rules and regulations regarding the tourism activities.
3. There should be proper planning for the endorsement & marketing of Sundarbans forest as a adventure tourist souvenir as alternative income generation opportunities for the people living in the area surrounding the Sundarbans.
4. To provide option for emergency / first aid medical service by the forest department, NAVY and the Coastguard.
5. To provide adequate security system for tourists & vessels inside the forest.
6. To learn about and support conservation-oriented programmes and organizations working to preserve the environment. Necessary for maintaining the general rules of waste disposals such as always use a bin to put the wastes or look for a safe place for disposal.
7. To patronize those peoples of hotels, resorts, cruise lines, tour operators and suppliers who could make aware about energy and environmental conservation; water and air quality; recycling; safe management of waste and toxic materials; noise abatement community involvement, and whose staff are experienced, well-trained and dedicated to strong principles of conservation.
8. Bangladesh forest department may arrange dialogue, seminar, workshop, meeting etc between the tour operators, local media, BIWTA, Coast Guard, NAVY, Forest department, other law and enforcement department & local community leaders in routine work basis.
9. Resource conservation related detailed research should be undertaken by sectoral integration of all stakeholders.

10. For a sustainable ecotourism of the Sundarbans, it is important to consider the carrying capacity of different tourist spots while giving permission to tourists vessels.
11. Good governance and monitoring approach in a holistic way is essential for promotion of ecotourism and sectoral coordination could ensure the sustainability of ecotourism in the Sundarbans.

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